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## PROTECTIVE HELMET AND RELATIVE METHOD FOR ITS PRODUCTION

The present invention relates to a protective helmet, in particular for use in sports such as motorcycling, skiing, cycling, roller-ball skating, and other sports, of the type comprising an outer cap made of a synthetic rigid material, an internal lining for the comfort of the wearer and a shock-absorbing shell, generally consisting of a cap made of expanded material, situated  
10  
15 between the external cap and the internal lining.

The production of helmets for motorcycling comprising a series of overlapping layers made of different materials, each of which having a specific function, is already known in the art. In particular, modern designed  
20 helmets normally envisage the use of an outer cap made of a synthetic rigid material, whose function is to prevent the intrusion of foreign bodies, in which a shock-absorbing shell is fixed, made of an expanded material and suitable for absorbing the energy of a possible impact.  
25 Finally, there is also a lining for the comfort of

the user, internally fixed to the shock-absorbing shell, whose function is to allow the helmet to rest comfortably on the head of the wearer.

The internal lining, which does not necessarily extend for the whole surface of the shock-absorbing shell, is generally a foam (or expanded material) of a synthetic material and/or cotton velvet and can be fixed to the shock-absorbing shell either irremovably by means of glues or resins or detachably with hooking frames previously attached to the shock-absorbing shell made of expanded material, by means of gluing or insertion, and then sewn to the comfort lining. It is not always easy to fix said comfort lining or hooking frames to the shock-absorbing shell, due to the surface heterogeneity and poor compactness of the synthetic expanded materials.

Furthermore, in the case of detachable internal linings, the substantial difficulty in fixing temporary hooking means, such as Velcro® strips, or pressure buttons, or laces, to the shell made of expanded material, for the internal comfort lining, makes this possible removability complex and costly.

It is also costly and complex to cover the whole internal surface of the shock-absorbing shell of expanded material and this also produces aesthetically negative results.

Another disadvantage, in the case of a removable comfort lining, is that the internal surface of the shock-absorbing shell made of expanded material is difficult to wash, as it is delicate and extremely porous.

5       With respect, on the other hand, to helmets with ir-removable linings, due to the solid adhesion of the internal lining to the shock-absorbing shell, it is almost impossible to obtain an efficient aeration flow between the wearer's head and the surrounding environment, with  
10 the result that, even if aeration channels or holes are envisaged in the shock-absorbing shell and outer cap, the air flow inside the helmet is greatly hindered by said comfort lining.

An objective of the present invention is to provide  
15 a protective helmet, particularly suitable for motorcycling, or skiing, or cycling, to be used with rollerballs or skates, and various sporting activities in which high speed protection is required, which does not have the drawbacks mentioned above.

20       Another objective of the present invention is to provide a protective helmet of the type comprising an outer rigid cap, a shock-absorbing shell and an internal comfort lining, in which the latter can be easily removed and substituted.

25       A further objective of the present invention is to

provide a protective helmet equipped with an internal surface for the hooking of the comfort lining which also acts as a support for a possible decoration.

Yet another objective of the present invention is to  
5 provide a protective helmet equipped with appendages, for example, with an aerodynamic function or for the protection of the user, which is easy to assemble.

The present invention also relates to a method for the production of a helmet which satisfies the objectives  
10 defined above.

These and other objectives are achieved by the protective helmet according to the first independent claim and subsequent dependent claims and by the method according to the fifteenth independent claim and subsequent  
15 claims depending thereon.

The protective helmet according to the present invention comprises an outer rigid cap to which a shock-absorbing shell made of expanded material is internally fixed and an internal comfort lining for the user, in addition to at least one intermediate cap made of a non-  
20 expanded material situated between the inside of the shock-absorbing shell and the internal comfort lining.

The affixing of an intermediate cap made of a non-expanded material attached to the shock-absorbing shell  
25 and suitable for acting as an interface between the lat-

ter and the internal comfort lining, has the purpose of enabling the simple attachment, possibly removable, of the comfort lining and at the same time allowing the inside of the helmet to be easily shaped and/or decorated.

5       According to a preferred aspect of the present invention, the intermediate cap is made of a thermoformable material selected from PET, PETG, polystyrene (polystyrene-EPS) and PC and is equipped with means for the temporary hooking of the internal comfort lining,  
10 such as hooking slits, Velcro® or clip-release buttons. This allows the simple substitution of said comfort lining and the use of possible visible surfaces of said intermediate cap as supports for decorations. The decoration, according to a particular aspect of the present in-  
15 vention, can be applied to the intermediate cap by means of adhesive labels or it can be directly printed on the intermediate cap, for example by means of screen printing. In particular, it is possible to decorate the intermediate cap when this, still in the state of a flat  
20 sheet, is to be subsequently thermo-formed for coupling with the shock-absorbing shell and with the comfort lining.

      According to another aspect of the present invention, the intermediate cap is shaped so as to have aeration  
25 tion channels and/or holes inside the helmet and it can

extend outside the volume delimited by the outer helmet,  
thus forming an appendage which can have an aerodynamic  
function or coadjuvate and considerably improve the aera-  
tion flow inside the helmet and also provide further pro-  
5 tection for the wearer.

A preferred embodiment of the present invention is  
now described hereunder, for purely illustrative and non-  
limiting purposes, with the help of the enclosed figures,  
in which:

10 figure 1 is a partial sectional view of a protective  
helmet according to the present invention;

figure 2 is a partial view from below of the helmet  
of figure 1; and

figure 3 is a block scheme of a method for the pro-  
15 duction of the helmet according to an aspect of the pres-  
ent invention.

With reference to figures 1 and 2, the helmet 1 ac-  
cording to the present invention comprises an outer cap 2  
made of a rigid thermoplastic material or composite fi-  
20 bres (for example Kevlar or aramidic fibres or glass fi-  
bres), to which a shock-absorbing shell 3 is internally  
attached, suitable for absorbing the kinetic energy of a  
possible impact, and an internal comfort lining, or pad-  
ding 5, whose function is to make the use of the helmet 1  
25 comfortable for the wearer.

The shock-absorbing shell 3, according to the known art, is made of a synthetic expanded material, such as for example polystyrene (polystyrene-EPS), whereas the internal lining 5 can be made of a plastic foam, or cotton velvet or any other soft material which facilitates the use of the helmet 1. The outer cap 2, whose purpose is to prevent the intrusion of foreign bodies inside the helmet 1, is normally made of PETG (polyethylene terephthalate glycol), PC (polycarbonate) or glass fibre.

10 The helmet 1 also comprises, according to the present invention, an intermediate cap 4, made of a non-expanded material, situated between the shock-absorbing shell 3 and the comfort lining 5, to act as an interface between these two elements of the helmet 1.

15 The purpose of said intermediate cap 4, which does not necessarily extend for the whole internal surface of the shell 3 and which can be variably shaped and cut, is to favour the fixing, possibly temporary, of the lining 5 inside the helmet 1, and also to form a support for the production of a possible shaping inside the helmet 1 and/or for the internal decoration of the helmet itself 1.

The presence, in fact, of the intermediate cap 4 made of a non-expanded material, such as for example PET, PETG, polystyrene or PC, allows the producer to provide

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an optimal support for fixing hooking means 6 for the lining 5, to the internal surface of the intermediate cap itself 4 and consequently to the outer region of the lining 5. In particular, the intermediate cap 4 allows the use of temporary hooking means 6, such as for example hooking slits produced in the intermediate cap itself 4, Velcro®, hooks, automatic pressure buttons (clips), or laces and rings, which proves to be particularly advantageous when the internal comfort lining 5 is intended to be made replaceable.

Furthermore, the possible rigidity and modeling simplicity of the intermediate cap 4, if this is made of PET or PETG or polystyrene or PC or any other thermo-formable plastic material, allows the inner surface of the cap itself 4 to be easily shaped and/or or decorated.

The intermediate cap 4 can also have the same function when it is made of fabric or artificial leather and also, when the thickness of the helmet 1 is to be reduced, when said cap is produced with an extremely limited thickness, even in the form of a film.

In particular embodiments of the cap 4, it is alternatively or jointly possible to use acoustical materials or materials with high absorption capacities of the kinetic energy of an impact or multi-layer composite materials, in order to provide said intermediate cap 4 with



specific technical characteristics.

Figure 2 illustrates a partial plan view from below of a helmet 1 equipped with an intermediate cap 4 and internal comfort lining 5 which only partially extends within the internal surface of the cap 4.

According to a particular aspect of the present invention, the latter, conveniently made of a thermoplastic material, has (see also figure 1) channels 7, 7a, 7b and/or pass-through holes (indicated as circles arranged along the channels 7a, 7b) which, by joining the area inside the intermediate cap 4 with the outer area 2 and surrounding environment, serve to increase the aeration inside the helmet 1.

In an embodiment which is not shown, the internal surface of the cap 4 can be possibly decorated to give the inside of the helmet 1 the desired aesthetic appearance. Furthermore, the intermediate cap 4 can be produced so as to extend outside the region delimited by the outer cap 2, to act as a possible aerodynamic appendage or element for conveying internal air flows, or as a further protective element for the user.

With reference to figure 3, a method is now described for the production of a helmet 1 according to a particular aspect of the present invention.

In its most general form, the helmet 1 according to

the present invention, is produced by means of the following phases:

- producing an intermediate cap 4, made of a non-expanded material (phase 101);
- 5    - producing (phase 102) the outer cap 2 and shock-absorbing shell 3 made of an expanded material, according to the known art, in addition to an internal comfort lining 5 for the user;
- fixing (phase 105) the intermediate cap 4 to the internal surface of the shock-absorbing shell 3; and
- 10    - attaching the internal lining 5 to the internal surface of the intermediate cap 4 (phase 106).

It can be observed that, whereas the production of the outer cap 2, the shell 3 and lining 5 is effected according to the known art, the fixing of the intermediate

15    cap 4 to the shock-absorbing shell 3, according to a specific aspect of the present invention, can be effected by gluing (phase 105 of figure 3) or with mechanical fixing means, but it can also be effected by means of co-

20    moulding (or in-mould moulding - sintering) of the shell made of an expanded material 3 on the intermediate cap 4.

According to this latter technique, after producing the intermediate cap 4, for example made of PETG or PET or polystyrene or PC, the granules of material to be expanded for forming the shock-absorbing shell, for example

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polystyrene, are withheld in an appropriate matrix above the cap 4 and are then expanded, by means of compression and appropriate thermal treatment, to form the shock-absorbing shell 3 firmly attached to the cap 4. At this point, the cap 4 together with the shell 3 is fixed, for example by insertion or by gluing, to the internal surface of the outer cap 2.

In the particular embodiment of the method according to the invention illustrated in figure 3, the helmet 1 according to the present invention is produced by means of the following phases in succession:

- production (phase 101) of the outer cap 2 and shock-absorbing shell 3 made of an expanded material;
- possible decoration (phase 104) of the internal surface of the intermediate cap 4 to obtain the desired aesthetic effect inside the cap 4 itself. In this embodiment of the method according to the present invention, the decoration (for example by means of printing) can be effected on the flat sheet (for example made of PET, PETG, polystyrene or PC) which, after thermo-forming (phase 102) forms the intermediate cap 4;
- production (phase 102), for example by the thermo-forming of the above sheet made for example of PET, PETG, polystyrene or PC, of the intermediate cap 4

- and subsequent cutting for coupling with the shock-absorbing shell 3 and with the comfort lining 5. During the thermo-forming phase of the intermediate cap 4, it is possible to produce holes and channels 7, 7a, 7b for the internal aeration of the helmet;
- affixing and/or production (phase 103) of suitable hooking means 6 on the internal surface of the cap 4, for example consisting of hooking slits, automatic buttons, strips of Velcro®, or clips;
  - 10 - gluing, or another permanent fixing technique, (phase 105) of the intermediate cap 4 to the internal surface of the shock-absorbing shell 3;
  - production of the comfort lining 5 equipped with hooking means corresponding to the hooking means 6 situated on the cap 4 (phase 106);
  - 15 - hooking (phase 107) of the comfort lining 5 to the cap 4.

According to other technical solutions, not illustrated but included in the protection scope of the present invention, the fixing (phase 105) of the intermediate cap 4 to the internal surface of the shock-absorbing shell 3 made of expanded material, can also be effected by means of an adhesive tape, bi-adhesive tape or by hooking of the mechanical type, in addition to the above-mentioned co-moulding technique.

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Furthermore, the hooking means 6, as already described with reference to figures 1 and 2 can be temporary, such as strips of Velcro® glued onto the internal surface of the intermediate cap 4 and on outer regions of the comfort lining 5, or slits situated on the intermediate cap 4 with clip-release or insertion hooking flaps on outer regions of the comfort lining 5, or with automatic buttons or clips fixed to the intermediate cap 4 and comfort lining 5.

10 The decoration phase 104 of the internal cap 4, moreover, can also be effected after the thermo-forming of the cap 4 itself, for example by means of printing or the gluing of adhesives. Similarly, the modeling of aeration channels and holes can be effected, according to  
15 other embodiments of the method according to the present invention, at any moment of the production phase of the intermediate cap 4.

The decoration 104 of the internal cap 4 can also be effected, in the case of a cap made of a transparent material, on the outermost surface of the cap 4 itself, or  
20 that in contact with the shock-absorbing shell 3 or, as mentioned above, directly on the internal surface in contact with the comfort lining 5.

From what is specified above, the advantages can be  
25 clearly seen of the helmet 1 according to the present in-

vention, or, thanks to the presence of the intermediate cap 4 made of a non-expanded material, the simple fixing of the comfort lining 5 to the inside of the helmet 1, the possible easy modeling, for example by means of channels and holes to allow an effective aeration and/or decoration of the internal surface of the helmet 1 itself, and the possibility of temporarily hooking the comfort lining 5, to enable substitution, to the intermediate cap 4, as well as the use of the cap 4 as a useful aerodynamic appendage or as an aid for the aeration of the inside of the helmet, or as a further safety element for the user.

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